## REMARKS

Claims 1-58 were pending prior to entry of the amendments herein. Claims 1-30 and 39-58 are herein canceled. Accordingly, Claims 31-38 are now pending.

Applicants submit that this application, as amended, is in condition for allowance and such action is earnestly requested. The Examiner's reason for rejection is addressed below.

**Rejections Under 35 U.S.C. §103**

Claims 31, 32, 35, 36, 37 and 38 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,816,900 ("Nagahara '900") or 5,931,719 ("Nagahara '719") to Nagahara et al. (collectively "Nagahara") and in view of U.S. Patent No. 6,004,880 to Liu et al. ("Liu"). The Examiner has found that the Nagahara patents teach an apparatus including a wafer carrier holding a wafer, a chamber having an upper opening and a compressible and flexible pad having a polishing surface, and fluid channels, wherein the pad is placed between the upper opening of the chamber and the wafer (or the face of the wafer), and wherein the pad is configured to bow outward and therefore apply more pressure at the center when a pressure in the chamber increases. The Examiner asserts that "neither Nagahara et al reference teaches using the apparatus for electrochemical mechanical deposition or polishing." However, the Examiner has found that Liu teaches "a method of electrochemical mechanical deposition and simultaneous polishing of semiconductor wafers." The Examiner has further found that Liu's method "has the advantage of being only one step instead of multiple steps of electrochemical deposition followed by mechanical polishing." The Examiner asserts that "it would have been obvious to one of ordinary skill in the art to have adapted the pad of Nagahara et al to be used in an electrochemical mechanical process as disclosed by Liu et al because integration of electrodes in a CMP apparatus allow for one step processing instead of two steps." Final Office Action at pages 2 and 3.

Applicants note that Nagahara is concerned with ***removing*** preexisting conductive material and maintaining planarity across a surface of a wafer during polishing by providing a non-uniform pressure distribution across a rotating polishing pad in order to compensate for lower material removal rates towards the center of the polishing pad. *See* Nagahara '719, col. 2, lines 56-67; Nagahara '900, col. 2, lines 18-22. Liu is concerned with filling surface features (e.g., trenches and/or vias) in an integrated circuit (IC) by maintaining a delicate balance between

the electrolytic deposition rate and the rate at which material is removed from the IC surface. In Liu, simultaneously planarizing the IC surface while filling the features ***prevents*** formation of a conductive film above the trenches and/or vias. *See* Liu, col 5, lines 63-37; col. 6, lines 7-13. Liu applies a voltage between an anode and the IC substrate to facilitate filling of the features. *See* Liu, col. 2, lines 10-26. Liu does not disclose rotating the supporting body 102 and/or the substrate holder 108 (*see* Liu, Figure 2) during processing.

Applicants respectfully disagree with the §103(a) rejections because the skilled artisan would have no motivation to combine Nagahara and Liu, and offer at least three reasons the skilled artisan would not have been motivated to make the asserted combination. Initially, it is not clear whether the Examiner is applying Nagahara as the primary reference or Liu as the primary reference. While styling the rejection as a modification of Nagahara, the Examiner's proffered suggestion states, "it would have been obvious...to have adapted the pad of Nagahara et al to be used in an electrochemical mechanical process as disclosed by Liu et al." However, Applicants submit that this characterization is irrelevant, as the arguments below apply to the asserted combination regardless of which reference is considered primary.

Nagahara is concerned with material removal, Liu is concerned with material deposition

Nagahara is concerned with ***removing*** pre-existing metal overlying a wafer while Liu is concerned with ***filling*** surface features in a dielectric. Thus, the skilled artisan would be dissuaded from making the asserted combination as the skilled artisan, intending to remove material over a wafer, would not be compelled to combine Nagahara's pad with Liu's electrode to simultaneously deposit material on the wafer. Nagahara is designed only for removal of copper and there would be no need to combine with Liu, which adds deposition to the process. The Examiner states that the combination would allow for one step processing instead of two steps, but does not identify the two steps in Nagahara.

To the extent the Examiner believes that Lui's addition of an electrode would aid in depositing the copper layer shown already present in Nagahara, then in reality Liu is being used as the primary reference. However, there is no indication that the structure of Nagahara is advantageous for this context, where Liu desires copper to be formed only in vias and trenches and not over the top surface of the dielectric. Nagahara applies higher central pressure to compensate for slower pad speed (and thus lower copper removal rates) at the center as

compared to the peripheral portions, a concern that applies only to the metal over the dielectric. See Nagahara '719, Col. 2, lines 56-67. There is no indication in the art at all that these same concerns are applicable to Liu's process, in which the pad serves only to maintain zero deposition on upper surfaces of the dielectric.

Omission of rotation would preclude need for central pressure as taught by Nagahara

In making the asserted combination, the Examiner assumes that Liu's pad rotates during processing, which assumption is not supported by any teaching or suggestion in Liu. Without such support, there would be no motivation to combine Nagahara and Liu because there is no reason to expect that features (e.g., electrode) associated with Liu's system would function in an advantageous manner when combined with Nagahara's rotating pad. As noted above, Nagahara derives benefits only by compensating slower speed with higher pressure at the center of the rotating pad. Liu, however, shows no desire or need for a rotating pad at all, and could employ, e.g., linear motion for its pad. The Examiner assumes a desire to employ rotating pads in the combination without any indication of the need or desirability therefor. Instead, the Examiner needlessly appropriates from Nagahara both a problem (rotating pad causing relative slowness at the center) and its solution (higher central pressure).

Liu discloses no rotation and the Examiner provides no reason to apply a rotating pad in the combination, i.e., no advantage to rotation per se. By choosing to combine a rotating pad from Nagahara with the rest of the teachings from Liu, without any advantage for rotation in that combination, the Examiner is just employing Applicants' claims as a blueprint. Omission of rotation would omit the need for central pressure taught by Nagahara.

In contrast, note that Applicants disclose advantages for central pressure that are independent of rotation, namely the reduction of bubbles. *See* Application at, e.g., paragraph [0058]. Only the hindsight benefit of Applicants' invention provides the requisite motivation to make the asserted combination.

The combination of Nagahara and Liu would upset the delicate balance established between material removal and deposition rates in Liu's process

Liu fills surface features while simultaneously polishing an IC surface in order to prevent formation of conductive films over the dielectric. This is achieved by establishing a balance between material removal and deposition rates.

> In a preferred embodiment of the present invention, the settings of the voltage source and the pressurizing mechanism are ***balanced*** such that the electrolytic deposition rate is substantially equal to the film removal rate. In other words, if an electrolytic deposition of a certain thickness takes place on the dielectric layer (excluding the deposition in the via hole or trench) at a certain setting of the voltage source, then sufficient pressure is applied by the pressurizing mechanism on the IC substrate so that the electrolytic deposition of the same thickness is removed simultaneously or almost at the same time from the dielectric layer surface. In this embodiment, the via hole and trench in the dielectric layer are filled with the electrolyte composition of the slurry, without any electrolytic deposition above the dielectric surface where there is no concave regions on the dielectric layer surface. Thus, the via hole and trench of the IC substrate are filled with the electrolyte and surface of the IC substrate is planarized simultaneously.
>
> Liu, Col. 5, line 63, to Col. 6, line 13 (emphasis added).

First, the skilled artisan would expect that the combination of Nagahara's non-uniform pressure distribution with Liu's polishing pad would upset the delicate balance established between material removal and deposition rates relative to Liu's process alone. Therefore, the combination is not associated with any expectation of success, and the skilled artisan would not be motivated to make the asserted combination. Second, as Liu's process alone achieves planarity during polishing and simultaneous filling of surface features, the skilled artisan would not be motivated to make the combination as there is no benefit to be gained from it.

Note that the lack of expectation of success does not depend on Liu being the primary reference. Even if Nagahara is treated as the primary reference, there is no indication that Nagahara's rotating pad, with higher central pressure, could effectively be combined with uniform plating using Liu's electrode. Neither the Examiner nor the references indicate how non-uniform speed and non-uniform pressure might affect the plating of Liu's system.

In summary, (1) Nagahara aims to remove metal while Liu aims to deposit metal; (2) no advantage for a rotating pad in the combinations is asserted; and (3) there is no indication that uniform plating could be expected in the asserted combination (which employs non-uniform pad speeds and pressure). All of these points lead to the conclusion that the art fails to suggest the asserted combination.

Applicants note that "to prevent the use of hindsight based on the invention to defeat patentability, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, ***the examiner must show reasons*** that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed." *In re* Rouffet, 47 U.S.P.Q.2d 1453, 1457-58, 149 F.3d 1350, 1457-58 (Fed. Cir. 1998) (emphasis added).

Without the hindsight benefit of Applicants' invention, the skilled artisan would have no motivation to make the asserted combination. Consequently, as there is no motivation to combine Nagahara and Liu, Applicants respectfully request that the §103(a) rejection of Claim 31 be withdrawn.

Claims 32 and 35-38 depend from and therefore include all of the limitations of Claim 31, in addition to reciting additional features of particular advantage and utility. The skilled artisan would have no motivation to combine Nagahara and Liu to arrive at the language of Claim 31, let alone the motivation to combine Nagahara and Liu to arrive at the language of Claims 32 and 35-38. Accordingly, Applicants respectfully request that the §103(a) rejections of Claims 32 and 35-38 also be withdrawn.

Claims 33 and 34 are rejected under 35 U.S.C. §103(a) as being unpatentable over either Nagahara '719 or Nagahara '900 in view of Liu as applied to Claim 31, and further in view of U.S. Patent No. 6,261,433 ("Landau"). Without acquiescing in the Examiner's reasons for rejection, Applicants submit that Claims 33 and 34 are allowable because they depend from and therefore include all of the limitations of Claim 31, in addition to reciting additional features of particular advantage and utility. Landau does not make up for the deficiencies of the prior art. Accordingly, Applicants respectfully request that the §103(a) rejections of Claims 33 and 34 be withdrawn.

Claims 39, 40, 43 and 44 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,876,271 to Oliver ("Oliver") in view of U.S. Patent No. 4,522,698 to Maget ("Maget") and Liu. Without acquiescing to the Examiner's reasons for rejection, Applicants submit that the §103(a) rejection of Claims 39, 40, 43 and 44 is moot in view of the cancellation of the claims.

## Conclusion

Applicants respectfully submit that all of the pending claims are patentably distinguishable and allowable over the prior art of record. The cited references, either alone or in combination, do not teach or suggest the claimed invention.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

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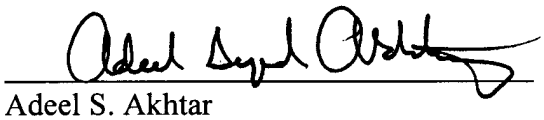
By: 

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